REMARKS

Applicant would like to thank the Examiner for the careful consideration given the present application. The application has been carefully reviewed in light of the Office Action, and the following remarks are presented for the Examiner's consideration.

Claim 1 is amended. Claims 16-21 are added. No new matter is entered.

Applicant would especially like to thank the Examiner for the telephone interview of November 3, 2008, in which the present Office action was discussed. No exhibits were shown. Specifically, the prior art of record was discussed in view of the claims of record. Additionally, various claim amendments were discussed to overcome the prior art of record, some of which appear in the instant response.

Claims 1-3, 9-10 and 12-15 were rejected under 35 U.S.C. 103(a) as being unpatentable over the cited publication entitled "High-Frequency, Long-Wavelength Resonant-Cavity-Enhanced InGaAs MSM Photodectectors" (hereinafter "Strittmatter") in view of U.S. Patent No. 5,945,720 to Itatani. For the following reasons, the rejection is respectfully traversed.

Claim 1 is not rendered obvious by the teachings of Strittmatter in view of Itatani. Specifically, Strittmatter does not teach or suggest "wherein the light to be detected is incident onto the device through the electrodes network forming the second mirror" as specified in amended Claim 1.

On the contrary, in Strittmatter *the light to be detected is not incident onto the device through the electrodes network* forming a highly reflecting top mirror. See page 146, § 1. Instead, the light to be detected is incident onto the device only in the case where *there is no top mirror*. See page 147, Figure 4, legend of the dashed line (i.e., "dashed line: frontside illumination without top mirror").

Indeed, Strittmatter teaches on page 145, § "Design and fabrication," that the device is illuminated through the InP substrate (not the top mirror) in order to avoid the loss of responsivity due to the blocking effect of the opaque interdigitated finger electrodes, which occurs when the MS detector is illuminated from the top (i.e., though the top mirror). In other words, a person of ordinary skill in the art applying the teaching of Strittmatter is in no way motivated to illuminate the top mirror.

Moreover, the combination of the electrodes network with the specific illumination as claimed is not obviously derived by applying the teachings of Itatani to the teachings of Strittmatter. Itatani teaches that the increase of the operating speed of the device is obtained by reducing the space between two consecutive electrodes (one can note that this technical effect is specified in the application, page 1, paragraph [0002]). However, this does not teach or suggest the combination of the present invention.

Specifically, Itatani does not teach nor suggest that the electrodes network can be designed so as to form a mirror for the resonant cavity, and that this network is composed of parallel conducting strips at a uniform spacing at a period less than the wavelength of incident light.

Thus, by applying the teachings of Itatani to the teachings of Strittmatter, a person of ordinary skill in the art is motivated to reduce the space between two consecutive electrodes, *and to illuminate the device from the rear of the device, which is different from the invention as claimed.*

Moreover, the claimed features of the present application result in electrodes being placed closely to each other without masking the light. In addition, the electrodes play a fundamental role in controlling the reflectivity of the second mirror (see page 8, line 29 to page 9,line 3 of the specification). The shortness of the paths followed by the photo carriers to be collected by the electrodes assures that this device has an *extremely fast intrinsic behavior* (response time less than one picosecond) while resonant coupling with incident light assures *a high external quantum efficiency* (a gain of about a factor of 10). See page 4, lines 6-13 of the specification. In contrast to prior art structures, the claimed structure results in *no compromise* between efficiency and speed (see page 1, lines 18-19 of the specification).

Accordingly, the combination of Strittamtter and Itatani would not have lead a person of ordinary skill in the art to the present invention. Therefore, claim 1 is not rendered obvious by the combination of the teachings of Strittmatter and Itanani. Thus, claim 1 and its dependent claims 2, 3, 9, 10 and 12-15 are patentable over the prior art of record.

Claims 4-6 and 7-8 were rejected variously under 35 U.S.C. 103(a) over Strittmatter in view of Itatani, U.S. Patent No. 5,663,639 to Brown, or U.S. Patent No. 6,528,827 to Henning. Neither Brown nor Henning teaches or suggest the limitations of which Strittmatter and Itatani

are deficient, as described above with regard to claim 1. Therefore, since claims 4-6 and 7-8 depend from claim 1, they are patentable for the same reasons.

Claims 16-21 are newly added. No new matter is entered. Support can be found in the original specification in at least page 7, lines 21-26, page 8, lines 22-28, page 9, lines 14-24, and page 13, lines 1-13.

Specifically, new claim 16 now states, in pertinent part, "wherein the distance separating the first mirror from the second mirror is equal to or less than about 100 nanometers." None of the prior art of record discloses or suggests such structure. Furthermore, variations of the distances separating the first mirror from the second mirror are not obvious as a matter of design choice for the following reasons.

The electrodes network is composed of parallel conducting strips at a uniform spacing at a period less than the wavelength of incident light, with the electrodes network forming the second mirror for the resonant cavity. In particular, the electrodes have to be well designed so as to form the resonant cavity.

In one example, such as for a wavelength of incident light equal to about 790 nm, the distance separating the lower and upper mirrors may be less than or equal to about 100 nm. For example, the distance separating the upper and lower mirrors can even less than or equal to about 70 nm, such as with 40 nm in the absorbent layer and 30 nm in the transparent layer. In addition or alternatively, the period of the electrode layer network may be 200 nm and the conducting strips may be 100 nm wide and 30 nm thick. See page 8, lines 22-28.

Thus, the instant application provides an ultra-fast photo-detector (response time less than 1 ps) for very high-speed optical fiber telecommunications (100 Gbits/s and faster). Indeed, the new MSM structure including the claimed resonant cavity can provide a means of absorbing more than 50% of incident light (such as for a wavelength of about 800 nm) in a 40 nm thick active layer with a space between electrodes of less than 100 nm. The efficiency is thus 25 times greater than the efficiency obtained by a single passage through the absorbent layer. See page 1, lines 8-17 and page 13, lines 1-13.

In distinction, each of Strittmatter and Itatani teach away from the instant application. A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *See* MPEP 2141.03. *See also* W.L.

Gore & Associates, Inc. v. Garlock, Inc., 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984). Indeed, "[w]hen the prior art teaches away from combining certain known elements, discovery of successful means of combining them is more likely to be nonobvious." *See* MPEP 2143. *See also* KSR, 550 U.S. at ___, 82 USPQ2d at 1395.

Strittmatter specifically discusses a photodetector having a thickness of at least 554 nm. See Fig. 1. For example, Strittmatter discusses a top mirror and a bottom mirror separated by at least an InGaAs absorber thickness of about 300 nm, an InP:Fe phase matching layer of about 224 nm, and an InP:Fe Schottky barrier enhancement layer of about 30 nm. See page 1.146, first paragraph. Indeed, Strittmatter teaches away from reducing the thickness between the mirrors, stating that a reduction in the active layer thickness "leads to a significant decrease in quantum efficiency for conventional MSM detectors illuminated perpendicular to the wafer surface." Furthermore, Itatani is silent as to a spacing between a first and a second mirror of a resonant cavity.

Moreover, Strittmatter discloses that the interelectrode spacing is about 1000 nm, with the electrode width is about 800 nm. Relatively slow response times are discussed. See page 1.148, Conclusion.

While Itatani does appear to note that a reduction in the width of the optical window can enable higher speed operation, it is noted that Itatani repeatedly explicitly discourages and teaches away from a width W of less than 300 nm. For example, Itatani notes that "an electrode gap cannot really be precision fabricated to a width W of 100 nm or less, and even 300 nm is quite difficult." See col. 2, lines 15-20. Itatani further states "This is because even if, in the device of this invention, the width W of the gap between the electrodes 12 is increased to more than the 300 nm of a conventional device, while observing the provision that the width W does not exceed the wavelength of the light to be detected, the lower risk of a dielectric breakdown occurring means that a higher voltage can be applied across the electrodes 12. Doing this would ease the fabrication process burden." See col. 9, lines 25-40.

Thus, for the reasons stated above, one of ordinary skill in the art would not be motivated to combine Strittmatter and Itatani because one would not want to compound the relatively slow response times of Strittmatter with the relatively large optical windows and/or fabrication problems taught and encouraged by Itatani.

Thus, for the reasons stated above, it is respectfully submitted that none of the prior art of record discloses or renders obvious new independent claim 16, or new dependent claims 17-21. Accordingly, it is respectfully submitted that all of new claims 16-21 are now in condition for allowance, and notice to that effect is hereby requested.

In consideration of the foregoing analysis, it is respectfully submitted that the present application is in a condition for allowance and notice to that effect is hereby requested. If it is determined that the application is not in a condition for allowance, the examiner is invited to initiate a telephone interview with the undersigned attorney to expedite prosecution of the present application.

If there are any fees resulting from this communication, please charge same to our Deposit Account No. 16-0820, our Order No. REG-37392.

Respectfully submitted,
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November 4, 2008